

R-13

F-10

INSTRUCTION BOOK

for

TYPE 16

**VHF VISUAL-AURAL RANGE RECEIVING
EQUIPMENT**



Manufactured by
AIRCRAFT RADIO CORPORATION
Boonton, N. J.

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for
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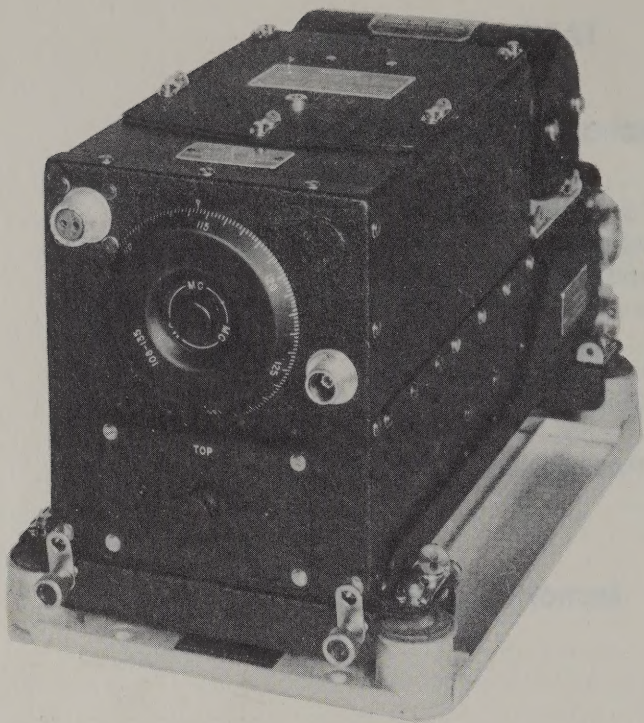


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JUNE 26, 1947

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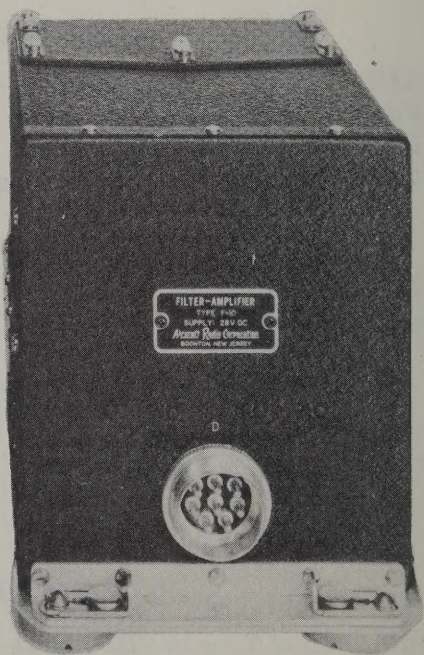
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**R-13 VHF RECEIVER
ON E-11 RACK AND
M-15 MOUNTING**



**C-14 CONTROL UNIT
ON M-14 MOUNTING**



**F-10 FILTER-AMPLIFIER
ON M-11B MOUNTING**

Figure 1—Principal Units of Type 16 VHF Visual-Aural Range Receiving Equipment

TYPE 16 VHF VISUAL-AURAL RANGE RECEIVING EQUIPMENT

SECTION I

GENERAL DESCRIPTION

1. INTRODUCTION

a. The Type 16 VHF Visual-Aural Range Receiving Equipment is designed for airborne use on any frequency in the range of 108-135 megacycles on the following facilities:

- (1) VHF simultaneous visual-aural airways radio ranges
- (2) VHF 90-150 cps runway localizers
- (3) VHF voice reception

b. The principle units of Type 16 equipment are shown in Figure 1, and a complete list of items supplied with each equipment is shown in Table 2, page 13.

c. Two aggregates of units are available, one for operation on a 14-volt d-c power supply, and a second for operation on a 28-volt d-c power supply.

d. Figures 4, 5, and 6 in the back of this book show the Schematic Circuit Diagram, Cabling Diagram, and Installation Dimensions and Weights, respectively.

2. NON-TECHNICAL THUMBNAIL SKETCH OF THE VHF FACILITIES

a. The VHF simultaneous visual-aural airways radio ranges (VAR ranges) provide a course that may be followed by observing a center-reading "cross-pointer meter" and another course that may be followed by listening to the familiar A-N signals with a steady dash for on-course. The visual course is usually along the airway and the aural at right angles to the airway. By listening for the A or N signal and noting whether the cross-pointer meter is in the blue or yellow sector of the cross-pointer meter, the quadrant may be identified immediately by reference to the CAA airway chart. VAR stations are set up according to the following conventions:

AIRWAY	*VISUAL COURSE		**AURAL COURSE	
	SECTOR OF C-P METER		AURAL SIGNAL	
	YELLOW	BLUE	A	N
GREE OR RED AMBER OR BLUE	SOUTH	NORTH	WEST	EAST
	EAST	WEST	SOUTH	NORTH

*Directions north, east, etc., are with respect to the VISUAL course.

**Directions north, east, etc., are with respect to the AURAL course.

b. VHF 90-150 cps runway localizers are the runway localizers that have been in use now for several years. Transmission of two modulations produces a sharp course indicated by center-reading of the vertical cross-pointer meter. Runway approach in the proper direction will result in center-reading. Furthermore, a movement of the needle to the right requires steering right to get back on course, and a movement to the left requires steering left to get back on course. If the approach is made 180° from correct, the reverse motions will occur.

c. VHF VOICE RECEPTION is possible simultaneously with the navigation facilities or on any frequency in the 108-135 mc band.

3. NO ADJUSTMENTS REQUIRED AFTER INSTALLATION

a. Type 16 equipments are delivered ready for installation in an airplane in any combination of serial numbers of Receivers and Filter-Amplifiers without adjustments.

4. MAINTENANCE PRIOR TO DELIVERY OF STANDARD TEST EQUIPMENT

a. It is recommended that Type 16 equipments be returned to Aircraft Radio Corporation for maintenance until such time as standard test equipment becomes available. In order to maintain the precision of the equipment, no component should be replaced in the Filter-Amplifier Unit without a check on the resulting course accuracy.

5. POSSIBLE OMISSION OF TYPE F-10 FILTER-AMPLIFIER UNIT

a. The Type 16 equipment is designed so that the F-10 Filter-Amplifier Unit may be omitted if operation on only VHF voice reception is required.

6. ANTENNA

a. An antenna is not supplied as part of a standard complement of Type 16 equipment because many potential customers already have one. It should be ordered as an extra item when required. The military AS-27/ARN-5 "ramshorn" antenna may be used.

7. RECEIVER SENSITIVITY, SELECTIVITY, AND SPURIOUS RESPONSES

a. The Receiver sensitivity is not poorer than 2 microvolts at any frequency in the tuning range. Conditions of measurement, $m=.3$, 400 cps, standard power output 10 milliwatts into 300-ohm resistive load.

b. The Receiver selectivity (bandwidth) is 100 kilocycles for 6 db and 350 kilocycles for 60 db.

c. The Receiver spurious response voltage ratios at any frequency in the tuning range are not poorer than:

1,000,000 to 1 for IF

40,000 to 1 for image

30,000 to 1 for (2 x Dial - 3 IF)

100,000 to 1 for (Dial - $\frac{1}{2}$ IF)

8. ACCURACY OF CALIBRATION OF RECEIVER CONTROL UNIT DIAL

a. In normal installations the accuracy of calibration of the Receiver dial is better than 0.1% and the Control Unit dial is better than 0.2%.

9. CROSS-POINTER METER

a. A cross-pointer meter is not supplied as part of a standard complement of Type 16 equipment because

many potential customers already have one. It should be ordered as an extra item when required.

10. USE OF TYPE R-13 VHF RECEIVER AS PART OF STANDARD MILITARY INSTALLATIONS FOR VHF VOICE RECEPTION

a. The Type R-13 VHF Receiver of this equipment may be operated in any stall of any standard military installation of SCR-274N, AN/ARC-5, or ATA/ARA for VHF VOICE reception only. It will be necessary to add a VHF antenna and to replace the Control Unit dial with the Control Unit dial normally supplied with the VHF Receiver. Electrical cabling and mechanical features have been designed to make this possible.

11. INPUT

a.	At 28 Volts D-C	At 14 Volts D-C
	2.3 Amps	4.6 Amps

b. The 14-volt and 28-volt equipments are not interchangeable due to dynamotors, relays, and heater wiring.

12. WEIGHT

a. The equipment, except antenna, cables, and mechanical linkage, weighs 18 pounds. The weight of each unit is shown in Figure 6 in the back of the book.

SECTION II

INSTALLATION

1. BENCH INSPECTION BEFORE INSTALLATION

a. The equipment, including all accessories and cables, should be set up on a bench and checked for normal operation before being installed in the airplane. The cabling diagram, Figure 5, shows the proper connections between units. Plugs and receptacles are so designed that it is impossible to make an improper connection.

2. LOCATION OF UNITS

See Figure 5 for the cabling and Figure 6 for the installation dimensions and weights of all major units. The information in Figure 6 has been included to assist CAA-licensed airplane mechanics in the preparation of weight and balance forms after installation of the Type 16 equipment.

a. **ANTENNA.** The Army-Navy Type AS-27/ARN-5 "ramshorn" antenna is the only antenna at present available for this use. This unit may be mounted on the topside conveniently near the Receiver. The location should be such that the antennas are horizontal in normal flight. A vertical antenna must not be used for navigation purposes but may be used if voice reception, only, is required. In the latter case the F-10 Filter-Amplifier is not required.

b. **CONTROL UNIT.** This unit is the only one that must be mounted in the cockpit. It should be within convenient reach, and the dial should be easily readable by the pilot.

c. **RECEIVER AND FILTER-AMPLIFIER.** The location of the Receiver and Filter-Amplifier is determined only by the balance of the airplane and the desirability of reasonable accessibility and short cables. It may even be desirable to sacrifice a certain amount of accessibility to reduce possible damage due to tinkering by non-technical people. If the equipment is being installed for VHF voice reception only, and not for navigation purposes, the F-10 Filter-Amplifier may be omitted. A bakelite cap, A.R.C. #5319, should be screwed onto the unused outlet on the Rack in this case.

e. **CABLES AND MECHANICAL LINKAGES.** Cables and mechanical linkage should not be so short that a strain is placed on the cables or units to which they are connected, nor so long that they have to be

coiled up. Bends in the mechanical linkage sharper than a 5 inch radius must be avoided. If it is necessary to make a sharper bend in certain installations, a separate right-angled coupling, A.R.C. #6357, weighing .08 pound, should be installed. This unit can be attached either to the Receiver or to the Control Unit. It is not sold as part of the standard complement. Securely fasten all cables and mechanical linkage to prevent them from becoming tangled in the controls.

f. **BATTERY CABLE.** The battery cable should be as short as possible to avoid excessive voltage drop in the leads which results in lower Receiver sensitivity.

3. FINAL ADJUSTMENT AFTER INSTALLATION

a. **CONTROL UNIT.** To adjust the tuning dial for correct frequency reading:

(1) Connect the mechanical linkage to the Receiver and to the Control Unit without regard to the location of the dial on the Control Unit, or to the tuning of the Receiver.

(2) Turn the tuning control counter-clockwise as far as it will go.

(3) Unscrew the knurled screw in the center of the Control Unit dial and rotate the dial until the small dot about $\frac{1}{8}$ " to the right of the 135 mc line comes directly under the triangular-shaped fiducial mark.

(4) Hold the dial with one hand and tighten the screw.

(5) Test the accuracy of dial-positioning by turning the control up to the stop and making certain that the fiducial mark is directly above this small dot. A further check should be made by tuning to some frequency in the band and noting that the Receiver and Control Unit readings agree precisely.

(6) The screw should be firmly tightened, not necessarily with a wrench.

b. **RECEIVER.** There are no adjustments to be made.

(1) Tune in stations over the band to get a check on the sensitivity and calibration.

c. **FILTER-AMPLIFIER.** There are no adjustments to be made.

(1) Tune in a runway localizer or a V-A range and check the sense of the visual cross-pointer indicator reading.

SECTION III

OPERATION

1. OPERATION ON THE 90-150 CPS SIMULTANEOUS VISUAL-AURAL RANGES

- a. Turn the ON-OFF power switch to ON.
- b. Tune in the desired transmitting station. Check the identifying signal.
- c. Note whether the vertical cross-pointer meter is in the blue or yellow sector and note whether the audio signal is an "A" or an "N". Refer to the CAA map for this VHF range station to determine the quadrant.
- d. While flying on-course on these visual ranges, the cross-pointer meter will be in the center, and regardless of whether the airplane is flying toward or away from the station, a movement of the needle into the blue sector will indicate that the plane is north of course if on a green or red airway, or west of course if on an amber or blue airway. And of course, if the needle moves to the yellow sector, the plane is south of course if on a

green or red airway and east of course if on an amber or blue airway. See the table on page 4 for further details.

2. OPERATION ON THE 90-150 CPS LOCALIZER

- a. Turn the ON-OFF power switch to ON.
- b. Tune in the desired transmitting station. Check the identifying signal.
- c. On approaching the runway in the normal sense, a reading of the meter to left or right of center indicates that the pilot must steer left or right respectively to bring the needle back to on-course center.

3. OPERATION ON VOICE

- a. Turn the ON-OFF power switch to ON.
- b. Tune in the desired station by reference to the dial. Maximize the tuning when the signal comes on.

SECTION IV

MECHANICAL AND ELECTRICAL CHARACTERISTICS

1. TYPE R-13 VHF RECEIVER

a. The Type R-13 VHF Receiver is a tunable unit for reception of amplitude-modulated signals in the band of 108-135 megacycles. It is a 9-tube superheterodyne using a 4-section gang condenser in the RF section and 8 tuned circuits at 15 mc in the IF section. Connection is made to the antenna through a balanced "twinax" line. The RF oscillator frequency is below the dial frequency. A noise-limiter and two stages of AF follow the detector. AF to the B-10 Converter and F-10 Filter-Amplifier is taken from the cathode of the 1st AF. The AVC is the delayed type which allows the output to build up to approximately 170 milliwatts before taking hold. Provision is made for overriding manual sensitivity control, but this feature is not used in the Type 16 equipment. The noise-limiter employs a series-diode circuit with provision for clipping signals above 80% modulation. The AVC diode connects to the 7th IF tuned circuit, leaving the last IF tuned circuit to provide aural tuning in lieu of a visual tuning meter. Power output from the knee of the AVC at approximately 6 microvolts, up to 100,000 microvolts input, rises from 170 to 360 milliwatts, for signals modulated 30% at 400 cps. Normal output load is 300 ohms. The sensitivity of the Receiver is not poorer than 2 microvolts at any frequency in its range ($m = .3$, 400 cps, 10 mw into 300-ohm load). The selectivity (bandwidth) is 100 kc for 6 db and 350 kc for 60 db. Particular attention has been paid in the Receiver design to keep spurious responses to a minimum. The spurious response voltage ratios are not poorer than

1,000,000 to 1 for IF

40,000 to 1 for Image

30,000 to 1 for (2 x Dial - 3 IF)

100,000 to 1 for (Dial - $\frac{1}{2}$ IF)

AF to the Type F-10 90-150 cps Filter-Amplifier is taken from the cathode of the first AF amplifier. This output will be unaffected by headset load. The AF amplifier in the Receiver has been designed to cut off signals at the low and high end of the AF spectrum with the result that the AF to the headset load is approximately 25 db down from maximum at 30 cps and at 10,000 cps. Considerable attention has been paid to the stability of tuning. The result is that for temperature changes from +50°C to -30°C, at any frequency in the band, from 3 minutes after turning on the set to the time of maximum drift, the tuning shift does not exceed 0.04%.

2. TYPE F-10 FILTER AMPLIFIER

a. The function of the F-10 Filter-Amplifier is to take the complex audio frequency signal voltage from the cathode of the 1st AF in the Receiver and convert it into d-c for operation of the vertical cross-pointer meter. The unit is a 2-stage resistance-coupled AF amplifier whose output is fed to a 90 cps and a 150 cps filter in parallel. Output from these filters is fed to rectifier circuits arranged to produce zero d-c in the cross-pointer meter when equal 90 and 150 cps signals are fed into the filters. The design is such that there are no adjustments. The input voltage to the filters is 45 volts, sufficient to produce the required off-course sensitivity of 90 microamperes through each of two cross-pointer meters for a 4 db differential of 90 and 150 cps input. This is sufficient to cause the meter to move to the outer edge of the yellow or blue region. In this equipment a second cross-pointer meter is simulated by a 1000-ohm resistor in the Rack.

b. "Flag-alarm" meter connections are provided in this unit but are not used at this time because flag-alarm cross-pointer meters are not yet available (May 1947).

3. TYPE E-11 RACK (WITH M-15 MOUNTING)

a. The Type E-11 Rack (with M-15 Mounting) provides the shock-mounting and inter-unit connections for the equipment. The design provides for quick installation or removal of the Receiver and Filter-Amplifier.

b. All TEL jacks on the Control Unit and Rack are connected in parallel and audio volume is controlled by the VOLUME control on the Control Unit. Circuiting is such that it is safe to connect the airplane TEL distribution system into any of the TEL jacks without fear of shorting the system at some setting of the VOLUME control.

4. TYPE C-14 CONTROL UNIT (WITH M-14 MOUNTING)

a. The Type C-14 Control Unit contains all operating controls. It includes the ON-OFF power switch, tuning mechanism, two headset jacks, and a headset VOLUME control.

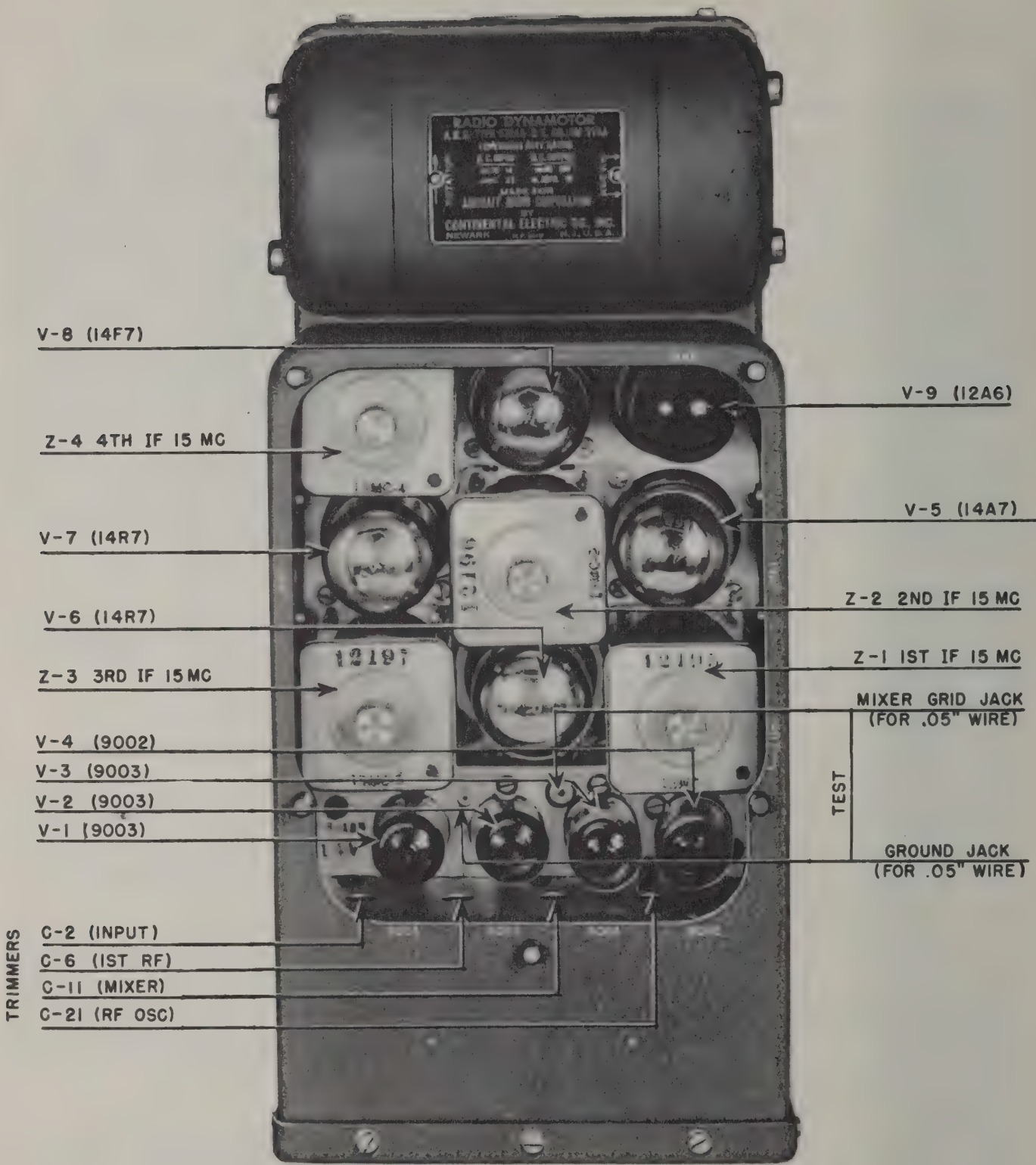


Figure 2—Top View of Receiver, Tube Cover Removed

SECTION V

MAINTENANCE

1. PREVENTIVE MAINTENANCE

a. The following points should be given attention at approximately monthly intervals:

(1) Check that nuts on all plugs and mechanical linkage are hand tight. Use of a wrench on these nuts is not recommended.

(2) Check that the antenna and leads thereto are secure.

(3) Check that headset plugs are secure and that cords are in satisfactory condition.

(4) Check that the Receiver and Filter-Amplifier are secure on their mountings and that snapslides are properly locked.

(5) Check that the Control Unit dial is positioned to read frequency accurately.

(6) Check for microphonics or clicks in the Receiver by listening to the headset response while striking the unit during operation.

b. Do not remove the equipment from the airplane unless trouble has developed which cannot be rectified on the spot.

2. SERVICING THE EQUIPMENT

a. EQUIPMENT REQUIRED:

(1) D-C voltmeter having ranges of 3, 30, 300 volts. Voltages shown on diagrams were taken with a voltmeter having 1000 ohms per volt.

(2) An outside antenna, for Receiver tests.

(3) A signal generator, capable of covering the frequency range of the Receiver, 108-135 megacycles, and of the IF, 15 megacycles.

(4) An A-C voltmeter having a range of 0-20 volts, for measuring Receiver output power into a 300-ohm resistance load.

(5) 14 or 28 volts of storage battery, depending on whether the 14 or 28-volt equipment is being tested. A 12 (or 24) volt battery may be used if allowance is made for test voltages as shown on the circuit diagrams.

(6) A complete Type 16 equipment with cables and mechanical linkage, and with all tubes marked, will be helpful in determining trouble by the substitution method. Always keep a set of standard marked tubes.

(7) Special test equipment is required for testing the Filter-Amplifier.

b. TROUBLE-SHOOTING SUGGESTIONS

BE CERTAIN TO CHECK THAT THE RECEIVER, DYNAMOTOR, AND FILTER-AMPLIFIER BEING TESTED ARE THE 14 OR 28 VOLT TYPES BEFORE CONNECTING THE STORAGE BATTERY.

(1) Check the cabling according to Figure 5 and make certain that the input voltage is 14 or 28 volts with + to the white-yellow battery lead. If a 12 or 24-volt battery is used, voltages obtained will be lower than those shown on the diagrams.

(2) Use the substitution method to locate the particular unit in which trouble exists.

(3) Have a standard set of tubes ready for insertion in the unit under test. See Figures 2 and 3 for tube locations.

(4) The schematic diagram in Figure 4 shows all important test voltages.

c. LOCATION OF TROUBLE IN THE RECEIVER

If the defect is in the Receiver, the following suggestions may help locate the trouble quickly.

NONE OF THE FOLLOWING TESTS SHOULD BE PERFORMED UNTIL A THOROUGH CHECK OF ALL TUBES HAS BEEN MADE.

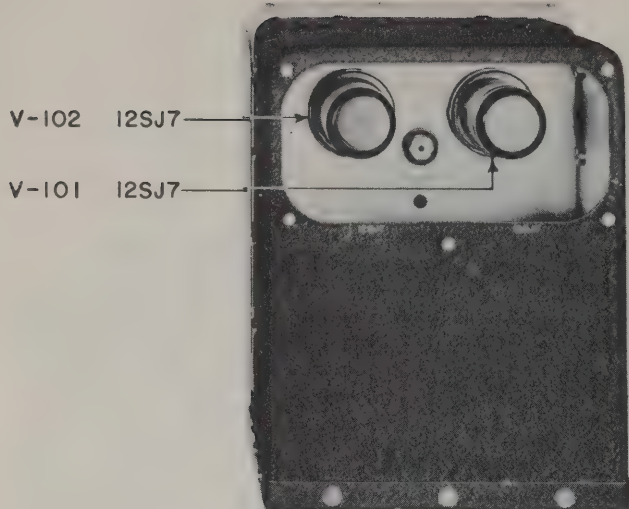
(1) Make a careful visual inspection for obvious mechanical defects.

(2) Test the Receiver sensitivity at the points shown in Table 1 in Section VI, starting with test 1 followed by tests 4 and 5. These tests will determine whether the trouble lies in the RF or IF section, or in the mixer at RF or IF. If the trouble is in the RF section, tests 2 and 3 should be carried out to isolate the trouble. If the fault is in the IF section, tests 6 to 9 should be carried out to isolate the trouble.

(3) Once the location of the fault has been found, a volt-ohmmeter should be used to check the voltages at tube terminals, and of circuit continuity or shorts.

d. ALIGNING THE IF CIRCUITS

If it becomes necessary to align the IF circuits, the following steps should be taken:



**Figure 3—Top View of Filter-Amplifier,
Tube Cover Removed**

(1) Make certain that the signal generator is tuned to precisely 15 megacycles. Connect it to the **TEST** jacks provided near V-3 on the RF preselector section. The jack for connection to the mixer grid may be identified by a ceramic insulator. Connection may be made to it by inserting a wire .050" (or #16) to bottom in the jack. Ground connection may be made to a nearby jack using a similar wire.

(2) Remove the knurled cap from each IF coupling unit. Align the fourth IF coupling unit Z-4 first, by adjusting the air trimmer on the secondary reached through hole 2. (A small metal screwdriver may be used for this because all trimmer rotors are grounded.) Keep the signal generator input at a level which produces not over 1 volt a-c across the load while performing these tests. Then trim the primary reached through hole 1. Continue this sequence for the third (Z-3), second (Z-2), and first (Z-1) IF coupling units. These are identified on Figure 2.

(3) Replace all knurled caps.

e. ALIGNING THE RF CIRCUITS

If it becomes necessary to align the RF circuits, the following steps should be taken:

(1) Tune the Receiver to 131 mc as indicated by the dial. Tune the signal generator precisely to this frequency. Do not depend on the calibration of the signal generator but check it against a crystal standard.

(2) Using condenser alignment wrench, A.R.C. part number 10307, adjust the four gang trimmers starting with the one on the right side of the Receiver and working to the left. This order is C-21, C-11, C-6, and C-2 as shown on the schematic circuit diagram, Figure 4. The most critical of these will be C-21. C-21 should be trimmed each time the RF oscillator tube, type 9002, is changed if the calibration accuracy is to be maintained. Changing of any of the other tubes will normally have relatively little effect.

f. LOCATION OF TROUBLE IN THE TYPE F-10 FILTER-AMPLIFIER

After making certain the trouble cannot be cured by tube replacements, refer to Figure 4 and

(1) Check all d-c voltages.

(2) Check for continuity where voltages are not reasonably close to those shown.

(3) If necessary to proceed further, apply an "on-course" signal to terminal #2 on J-101. This should be 90 and 150 cps of 1 volt each, measured separately on the Ballantine voltmeter. Under these conditions the two vertical cross-pointer meters should read center and the a-c at the J-102 **TEST** jack should read 45 volts.

(4) Overall amplification may be altered by changing the plate resistor in V-101. Adjustments for zero reading of the cross-pointer meters may be made by changing R-108 or R-109, as required. These should be overhaul adjustments only, and are therefore fixed resistors to reduce the possibility of field misadjustments.

(5) A 4 db difference in the 90 and 150 cps signals should produce a swing to the outer edge of the yellow or blue sectors of the cross-pointer meters.

(6) The F-10 Filter-Amplifier is delivered to the customer ready for operation with any of the Receivers of the Type 16 equipment. No adjustments are necessary. All Receivers and all F-10 units are completely interchangeable for this function.

SECTION VI

SUPPLEMENTARY DATA

TABLE 1—SENSITIVITY

Microvolts, modulated 30% at 400 cps required to produce 10 milliwatts output into a 300 ohms resistive load (1.73 volts across 300 ohms) is shown for nine points. The input voltage is 14.0 or 28.0 for the 14v and 28v equipments, respectively. Microvolt values shown are approximate. Variations of as much as 2 to 1 in the values shown from antenna through the mixer grid at RF may be expected, but variations of less than 2 to 1 for all IF measurements should be observed. Use a .006 mfd mica capacitor in series with the signal generator

lead to prevent upsetting biases for all except measurements at the antenna and mixer grid receptacles. Make overall measurements at 131 megacycles.

If an unbalanced output line from a signal generator is used instead of a balanced line, connect the high side to either of the two twinax contacts leaving the second unconnected. Connect the ground of the signal generator to the shell of the connector. Divide the microvolts obtained by two.

<i>Test Number</i>	<i>Signal Generator Connected to</i>	<i>Frequency (MC)</i>	<i>Approximate Microvolts</i>
1	Ant. receptacle	131	1
2	1st RF grid (V-1, term. #1)	131	5
3	2nd RF grid (V-2, term. #1)	131	25
4	Mixer grid (V-3, "TEST" receptacle, see Fig. 2)	131	150
5	Mixer grid (V-3, "TEST" receptacle, see Fig. 2)	15	270
6	1st IF grid (V-5, term. #6)	15	2,100
7	2nd IF grid (V-6, term. #6)	15	28,000
8	3rd IF grid (V-7, term. #6)	15	340,000
9	Detector anode (V-8, term. #5)		
	Change modulation to 60% for this test in order to obtain the necessary 10 milliwatts output.	15	2,240,000

TABLE 2
LIST OF MAJOR UNITS AND ACCESSORIES FOR TYPE 16 VHF VISUAL-AURAL RANGE RECEIVING EQUIPMENT

<i>A. R. C. Type No.</i>	<i>A. R. C. Part No.</i>	<i>Name (Description)</i>
R-13(14v) } R-13(28v) }	12014	Receiver (VHF, tunable, 108-135 mc, less Dynamotor Unit but with tubes and #6433 Adapter; choice for 14v or 28v supply)
E-11	12503	Rack (Receiver)
M-15	7059	Mounting (Rack and Receiver, shockproof)
D-11(14v) } D-11(28v) }	5206 7351	Dynamotor Unit (choice for 14v or 28v supply)
C-14	12304	Control Unit (remote, Receiver)
M-14	7053	Mounting (Control Unit)
F-10(14v) } F-10(28v) }	12018	Filter-Amplifier Unit (90-150 cps, with tubes; choice for 14v or 28v supply)

TABLE 2—Continued

LIST OF MAJOR UNITS AND ACCESSORIES FOR TYPE 16 VHF VISUAL-AURAL
RANGE RECEIVING EQUIPMENT

M-11B	12707	Mounting (Filter-Amplifier Unit, shockproof)
—	—	Instruction Book
—	—	Complement of Mechanical Linkage, Bulk Cable, and Plugs, as follows: Mechanical Linkage Assy. #6151, length 7 ft., or see Note 1; 20 ft. each of Bulk Cable #11834, #11835; 10 ft. each of Bulk Twinax Cable #12327; one each of Plugs #12728, #12378, #12323; two each of Plugs #11924, #12330, #12098

NOTES

(1) A 7 ft. length of assembled #6151 Mechanical Linkage is supplied unless specifically ordered to the contrary. Orders for lengths under 7 ft. will be at the quoted price. Orders for lengths above 7 are extra.

(2) Although an antenna and a cross-pointer indicator meter are required for normal operation of Type 16 equipment, these units are not included in the standard complement because in many cases the customer will already have one of each installed. They should be ordered as extra items when required.

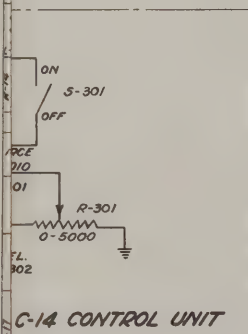
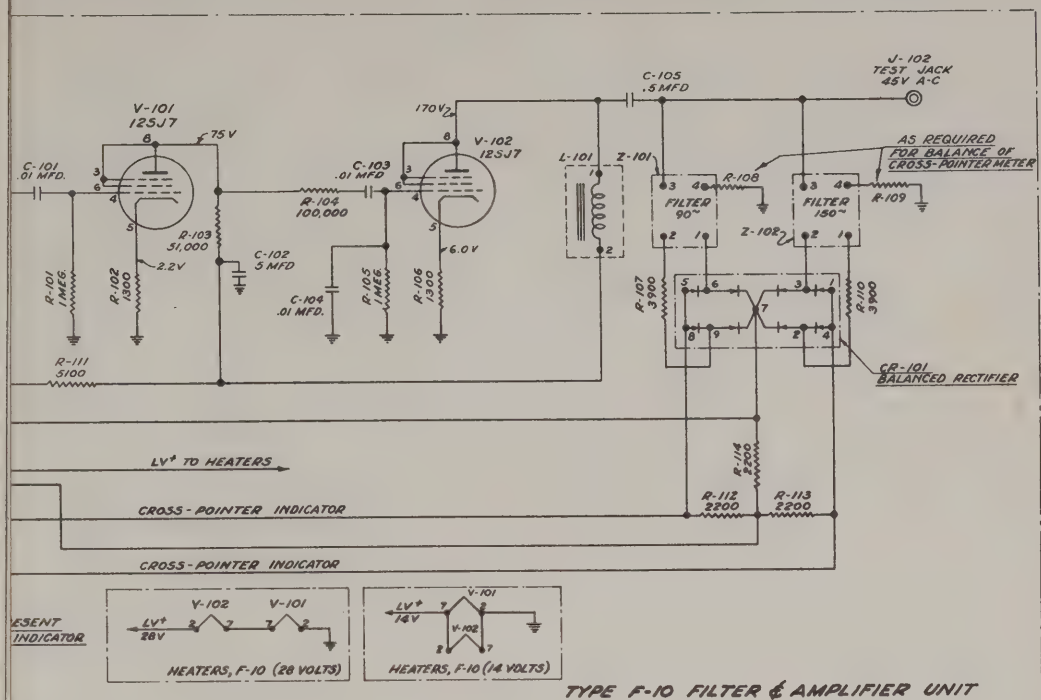


Figure 4—Schematic Circuit Diagram, Type 16 VHF Visual-Aural Range Receiving Equipment

TABLE 2—Continued

LIST OF MAJOR UNITS AND ACCESSORIES FOR TYPE 16 VHF VISUAL-AURAL
RANGE RECEIVING EQUIPMENT

M-11B	12707	Mounting (Filter-Amplifier Unit, shockproof)
—	—	Instruction Book
—	—	Complement of Mechanical Linkage, Bulk Cable, and Plugs, as follows: Mechanical Linkage Assy. #6151, length 7 ft., or see Note 1; 20 ft. each of Bulk Cable #11834, #11835; 10 ft. each of Bulk Twinax Cable #12327; one each of Plugs #12728, #12378, #12323; two each of Plugs #11924, #12330, #12098

NOTES

(1) A 7 ft. length of assembled #6151 Mechanical Linkage is supplied unless specifically ordered to the contrary. Orders for lengths under 7 ft. will be at the quoted price. Orders for lengths above 7 are extra.

(2) Although an antenna and a cross-pointer indicator meter are required for normal operation of Type 16 equipment, these units are not included in the standard complement because in many cases the customer will already have one of each installed. They should be ordered as extra items when required.

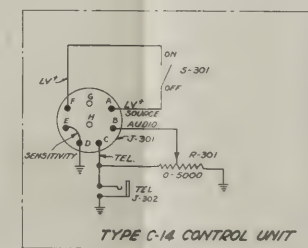
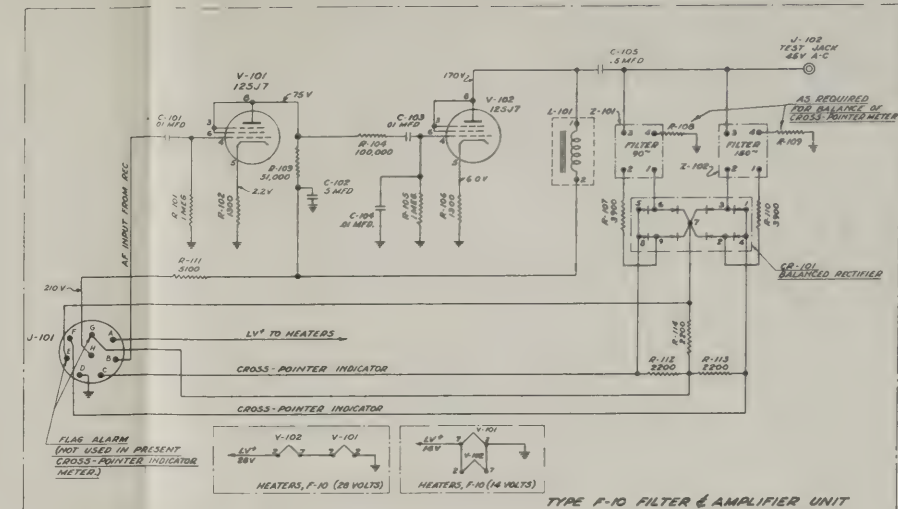
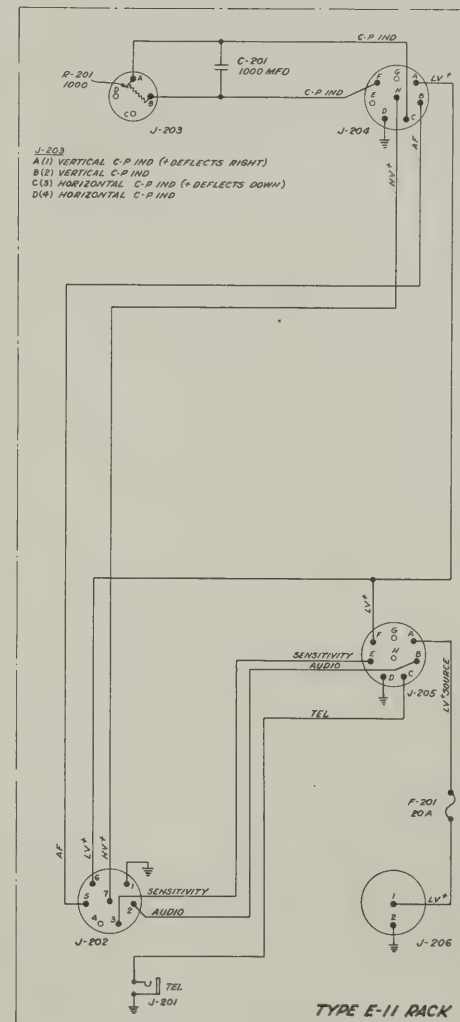
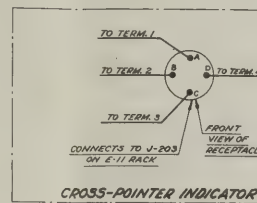
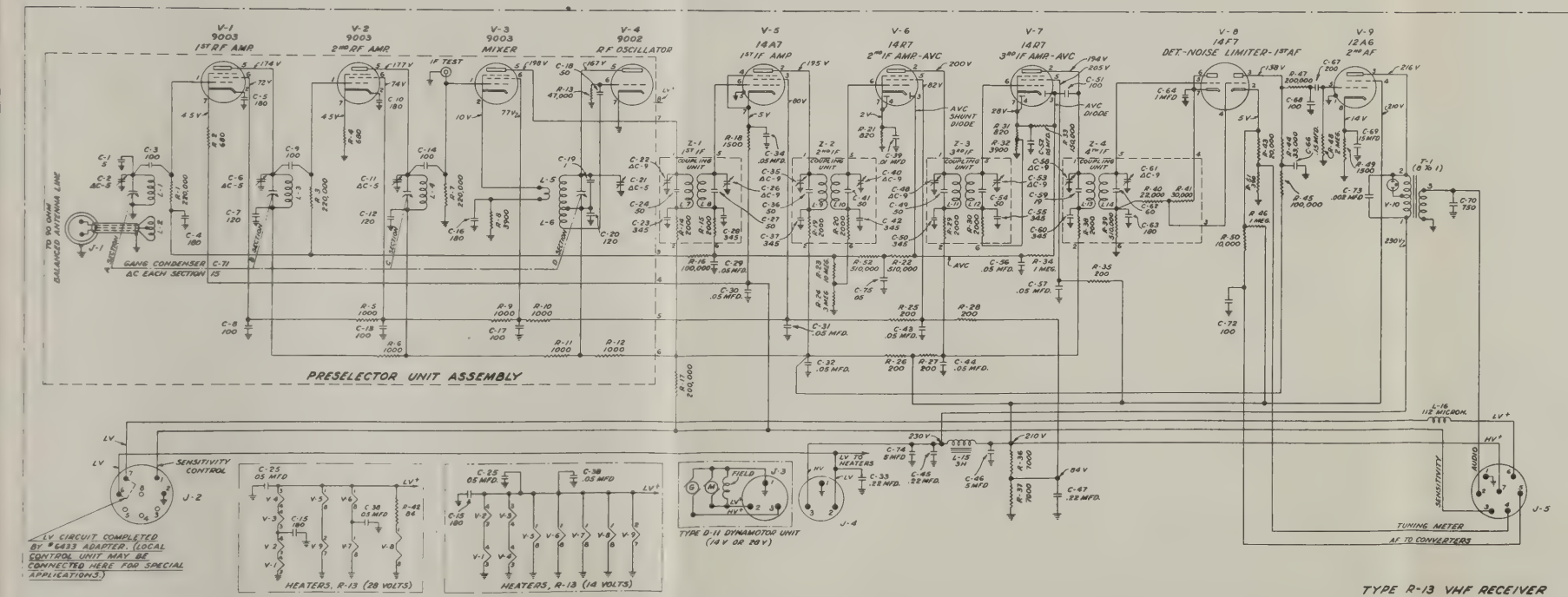


Figure 4—Schematic Circuit Diagram, Type 16 VHF Visual-Aural Range Receiving Equipment

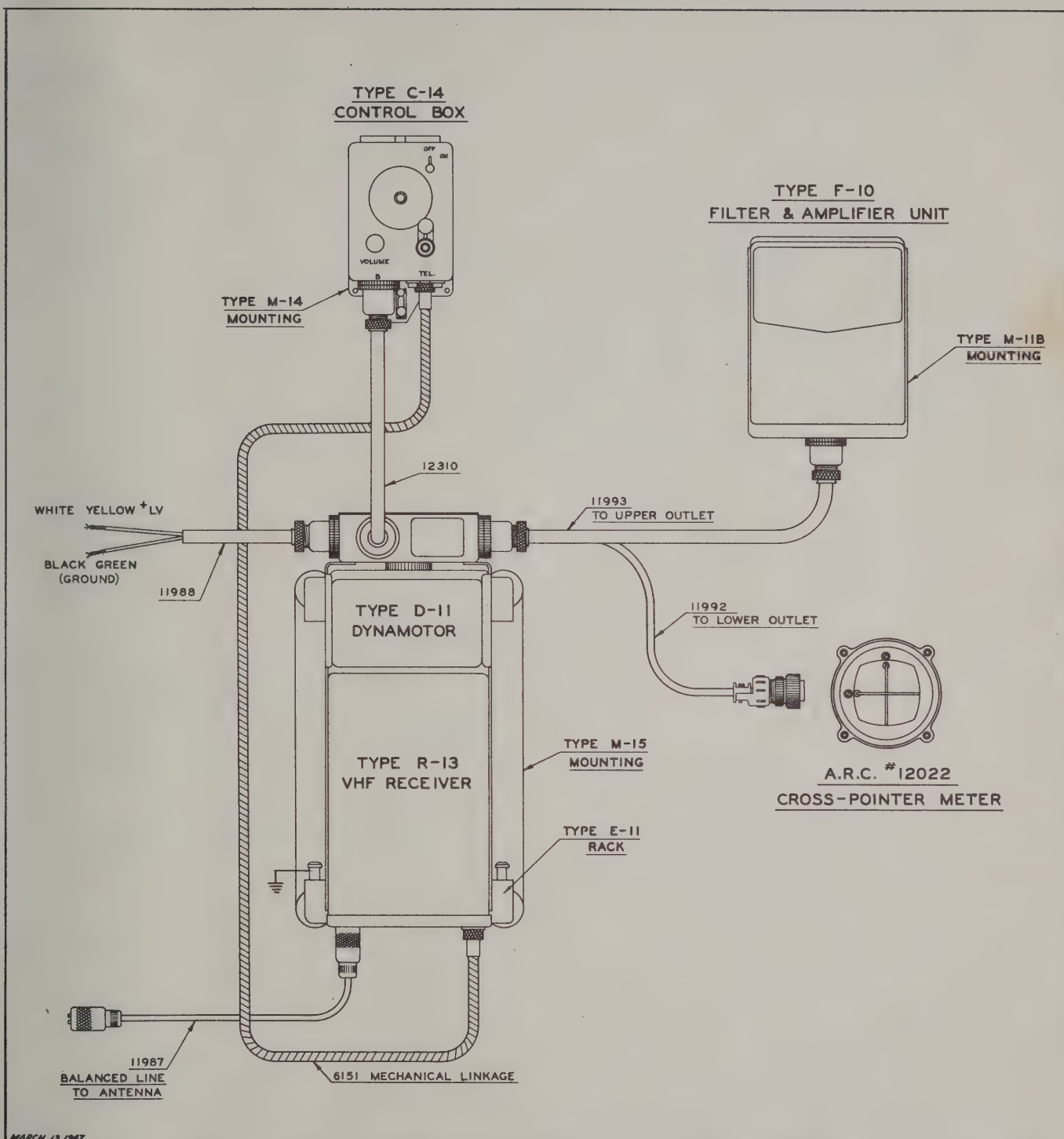


Figure 5—Cabling Diagram, Type 16 VHF Visual-Aural Range Receiving Equipment

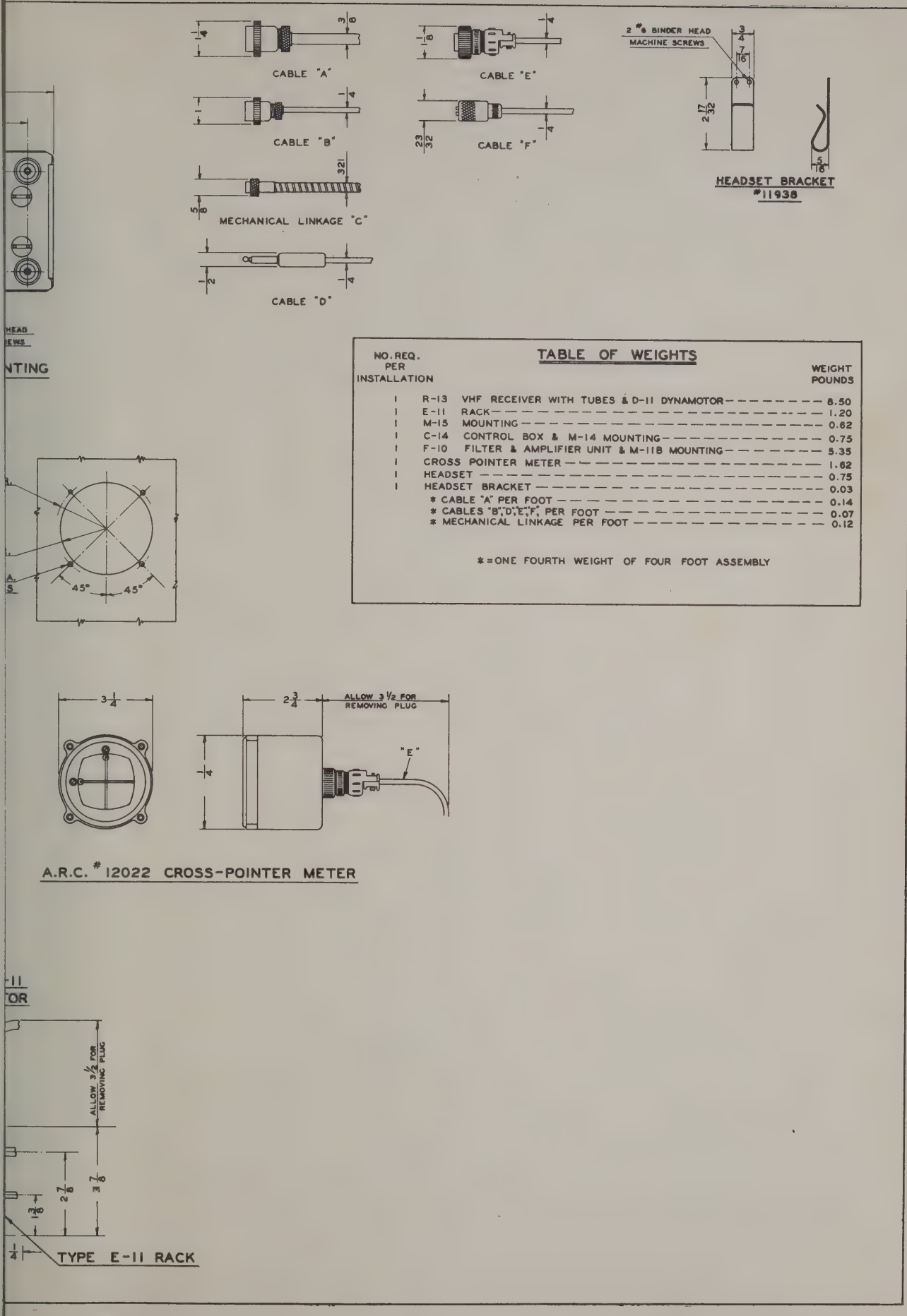
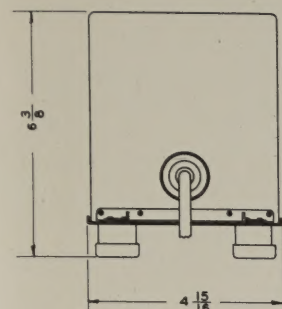
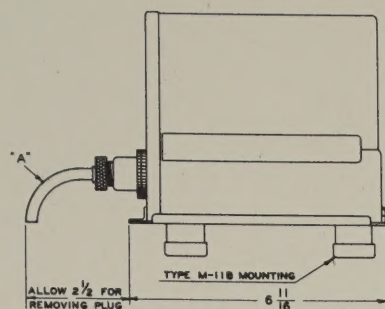


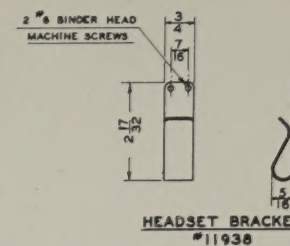
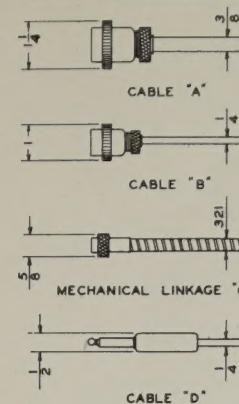
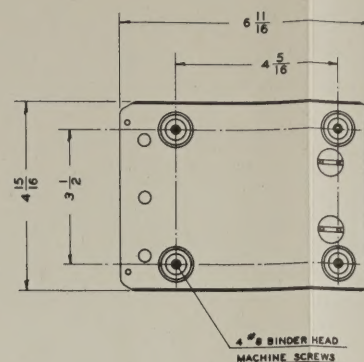
Figure 6—Installation Dimensions and Weights, Type 16 VHF Visual-Aural Range Receiving Equipment



TYPE F-10 FILTER & AMPLIFIER UNIT

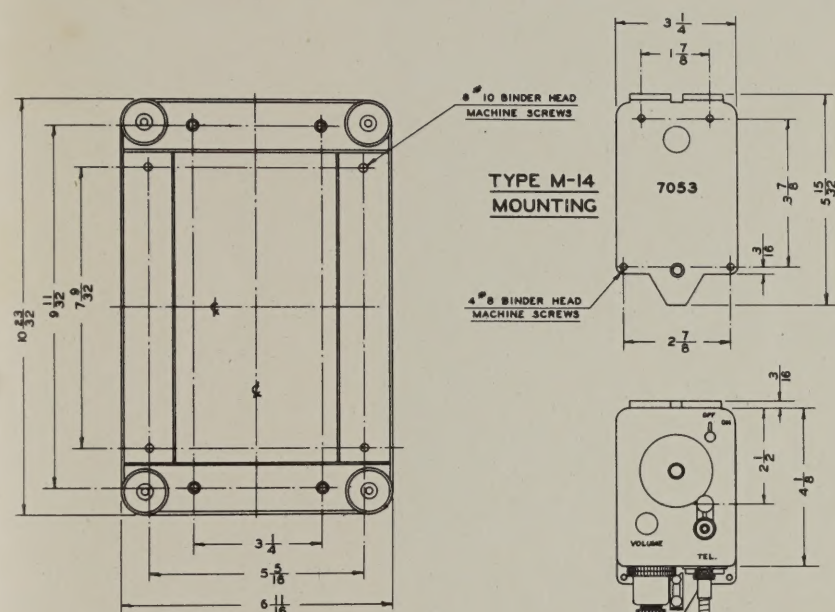


TYPE M-11B MOUNTING

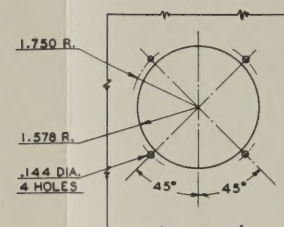
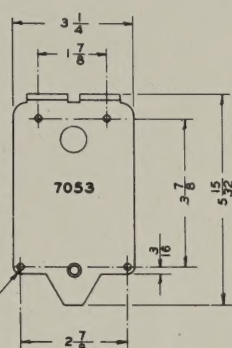


NO. REQ. PER INSTALLATION	TABLE OF WEIGHTS	WEIGHT POUNDS
1 R-13 VHF RECEIVER WITH TUBES & D-11 DYNAMOTOR		8.50
1 E-11 RACK		1.20
1 M-15 MOUNTING		0.62
1 C-14 CONTROL BOX & M-14 MOUNTING		0.75
1 F-10 FILTER & AMPLIFIER UNIT & M-11B MOUNTING		5.35
1 CROSS POINTER METER		1.62
1 HEADSET		0.75
1 HEADSET BRACKET		0.03
* CABLE 'A' PER FOOT		0.14
* CABLES 'B','D','E','F' PER FOOT		0.07
* MECHANICAL LINKAGE PER FOOT		0.12

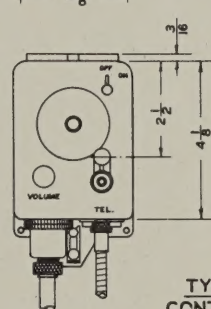
*=ONE FOURTH WEIGHT OF FOUR FOOT ASSEMBLY



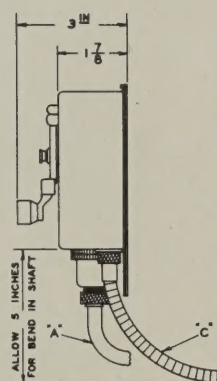
TYPE M-14 MOUNTING



A.R.C. #12022 CROSS-POINTER METER

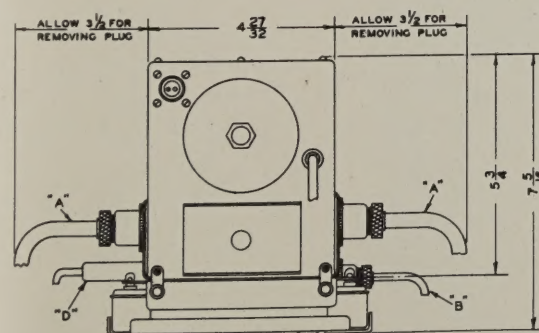


TYPE C-14 CONTROL BOX

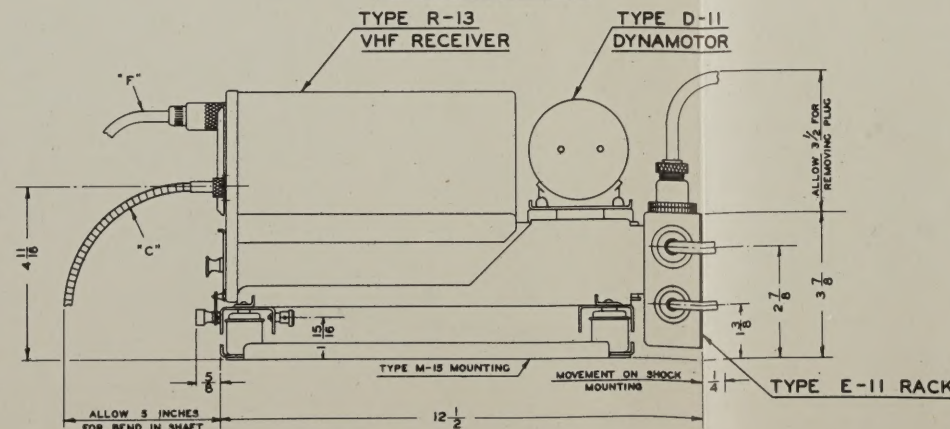


TYPE R-13 VHF RECEIVER

TYPE D-11 DYNAMOTOR



TYPE M-15 MOUNTING



TYPE E-11 RACK

Figure 6—Installation Dimensions and Weights, Type 16 VHF Visual-Aural Range Receiving Equipment

